DECK STRENGTH

*Ship*Wanted!

Ship For Sale Ad

Ref ID	1320
Vessel Type	BARGES
Short Description	Deck Barge - Ocean
Builder Location	United States
Year Built	1970
Capacity	12500 DWT
Length(m)	
Service Speed (knots)	
Date Posted	2004-09-20 02:54:00.0
Price(USD)	
Description	

Flag: U.S.
Built: 1970, Todd Shipyard USA
400.0 ft. LOA x Beam: 99.5 ft. x Depth: 20.0 ft.
Draft: 3.8 ft. light 14.1 ft.loaded
Dwt: 12500 Lt. Disp: 2975.0 mt.
G / NRT: 4860.0 / 4860.0
ABS + A1. Out of class. USCG COI - expired.
ClearDeck: @ 36,965ft2
Deck Strength: 1,066 psf
WT Comp: Bulkheads: 2 long'l/7 transv.
Double Rake

Remarks: Flat deck cargo barge. Breakwater forward. 95.5st TPI. Laid up. Last used in '94 Sealift from Louisiana to Prudhoe Bay, Alaska. Good for dock, log sorting, etc.

Laid up Tacoma, Washington. As brokers try usd 425,000 on as is where is basis.

FOR FURTHER INFORMATION PLEASE CONTACT
SNP@shipwanted.com

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MILITARY

Cape H Class - Ro-Ro

On 12 June 1998 US Transportation Secretary Rodney E. Slater announced the award of a total of 39 performance-based contracts to 10 American ship-owning and -operating companies to manage 89 ships of the Ready Reserve Force. The total estimated value for the contracts included the expected costs of shipyard work and other maintenance and operational expenses for which the ship managers are reimbursed. Keystone Shipping Services, Inc. of Bala Cynwyd, PA was awarded $13,822,690 over 5 years for Cape Henry, Cape Horn and Cape Hudson.

Following this announcement of contracts to manage RRF ships in 1998, MARAD independently discovered an error in the award process, and rescinded the contracts. It extended existing contracts to make sure the ships remained mission ready. On 04 May 2000 Maritime Administrator Clyde J. Hart Jr. announced the award of 33 contracts, awarded on a competitive basis, to nine American ship owning and operating companies to manage 74 of the Ready Reserve Force ships. Marine Transport Lines, Inc. of Weehawken, NJ was awarded $15,932,462 for Cape Henry, Cape Horn, and Cape Hudson.

The Cape H class of RO/RO ships were designed as combination RO/RO and container carriers for operations in underdeveloped ports. Lift-on operations are accomplished with a 39-LTON capacity pedestal. Three Cape H RO/RO-class ships served with the Army Preposition Afloat [APA] program: the MV Cape Henry, MV Cape Horn, and MV Cape Hudson. They can carry up to 6,766 standard ISO containers spread over four holds and have a 39-ton crane to unload the containers. They have a fixed 63.9-ton capacity vehicle ramp on the starboard/stern quarter. The ramp allows RO/RO operations to the starboard side or aft only. These ships have an

overall capability of carrying 180,000 square feet of cargo.

The cargo capacity of each ship includes a 34,000 (25,500 at 75%) square foot hoistable deck that has only 6.4 feet of vertical clearance with a deck strength of 41 pounds per square foot that may be of limited military utility.

A Roll-On/Roll-Off [RO/RO] ship is specifically designed to carry wheeled and tracked vehicles as all or most of its cargo. Vehicles are driven or towed on and off the ship by means of either the ship's own ramps or shore-based ramps. Because it is designed to accommodate cargoes which cannot be stacked but which vary in height, below-deck space and volume utilization is generally less efficient than on a containership. RO/RO ships are thus commercially viable only in certain specialized trades. However, the RO/RO is the preferred ship type for deployment of military unit equipment. The military advantages of RO/RO ships include the capability for rapid

loading and discharge of military vehicles and non-self-deployable aircraft, and open deck areas well suited to the carriage of outsized military cargo. Their military disadvantages include their relative unsuitability for carriage of sustaining supplies and ammunition (in comparison with general cargo and containerships) and their limited availability, because their market sector is much reduced compared with containerships.

The RO/RO ship is primarily a vehicle transporter that allows vehicles to drive on or off the ship via ramps. RO/RO cargo includes wheeled, tracked, self-propelled, and towed vehicles and equipment. A series of external and internal ramps facilitate the loading and discharge of RO/RO cargo. To maintain safe operations, the ramp angle for loading/unloading procedures is no greater than 15 degrees. When designing wheeled or tracked equipment, the materiel developer/contractor must allow for adequate clearance underneath the vehicle to prevent contact at the ramp crest/toe for a 15 degree ramp and enough clearance above the vehicle to prevent projection interference problems.

Comparison of Principal Characteristics
SMR/PRV/FRV-40

	Current SMR	PRV	NOAA-FRV
Ship Size			
	Intermediate size (UNOLS Class III)	Intermediate size (UNOLS Class III)	Intermediate size (UNOLS Class III)
	Draft not to exceed 15 feet	Draft of 13'-6"	Draft of 19.4 feet
	Length < 210 feet		Length of 206.7 feet
Endurance			
	Remain at sea for 60+ days	Remain at sea for 90 days	Remain at sea for 40 days
	Hotel service for 75 days		
Range			12,000 nautical miles at 12 knots
Accommodations			
	24 Scientists (including 2 marine techs)	30 Scientists	19 Scientists
		22 Crew	20 crew
Speed			
	14 knots maximum	14 knots maximum	14 knots maximum
	10 knots in SS 5	8 knots in SS 5	11 knots in low SS 5, 4 knots in low SS 6
	Speed control +/- 0.5 knots in 0-7 knot range	Speed control +/- 0.2 knots in 0-7 knot range	Speed control continuous in 0-14 knot range
		Speed control +/- 0.1 knots in 0-2 knot range	
Ice Strengthening			
	ABS A1	ABS Ice Class 3	ABS Class C0
Maneuvering Performance			
	Station keeping in SS 5 at best heading	Station keeping in SS 5 at best heading	Station keeping in low SS 5 at best heading
	Trackline to 7 knots in SS 5 w/max excursion of 50 feet		Acoustic survey trackline to 11 knots in low SS 5 w/ max excursion of 50 meters
			Towing trackline to 3 knots in low SS 5 w/ 160 kN tow and max excursion of 100 meters
			Slow speed trackline to 1.0 knot in low SS 5 w/ 17.8 kN tow and max excursion of 10 meters
Seakeeping			
		Maintain science operations in:	Max roll angle of 4 degrees RMS at work stations
		10 knots cruising through SS 4	Max pitch angle of 2.25 degrees RMS at work stations
		8 knots cruising through SS 5	Max vertical acceleration of 0.2 g RMS at work stations
		6 knots cruising through SS 6	Max lateral acceleration of 0.1 g RMS at work stations
Deck Working Areas			
	Stern area of 2,000 square feet	Stern, open area of 1,820 square feet	Stern, open area of 2,766 square feet
		Stern, enclosed area of 540 square feet	
	Contiguous side deck of 50 feet	Contiguous side deck of 88 feet	Contiguous side deck of 100 feet
			Min distance from top of trawl ramp to net reel of 47 feet
	Freeboard to working deck of 4-6 feet	Freeboard to working deck of abt. 6 feet	Freeboard to working deck of 9 feet
	Deck loading of up to 1,200 lbs/sq. foot		
	Aggregate total deck load of 45-50 tons		
	Standard UNOLS bolt-down pattern	Standard UNOLS bolt-down pattern	Standard UNOLS bolt-down pattern
	Useable foredeck area	Useable foredeck area	Useable foredeck area
Cranes			
	One 20,000 lb capacity	One 20,000 lb capacity	Two telescoping boom cranes, 13,000 lb capacity
	One 2,000 lb capacity for towing over-side	One 10,000 lb capacity knuckle-boom	
	One small crane on foredeck	One small crane on foredeck	One small crane on foredeck
Winches			
	Two trawl winches		Two trawl winches
	One net reel		One net reel
	One net sonde winch		One net sonde winch
	One gilson winch		One gilson winch
	One outhaul winch		One outhaul winch
			Space for one drop target strength winch
	One hydro winch	Two hydro winches	Two hydrographic winches
	One deep tow winch	One deep tow winch	One oceanographic winch
Coring and Dredging			
	Piston coring to 66 feet	Cores of 80 feet	
Overboard Handling			
	Stern A-frame	Articulated A-frame at stern	Stern A-frame
	Side A-frame	Articulated A-frame at side	Side A-frame
	Baltic Room with overhead rail	Baltic Room with hydraulic "squirt" boom	
	Trawl ramp		Trawl ramp
Control Stations			
	Aft winch station	Aft winch station	Side winch station
Towing			
	Capable of towing packages to 10,000 lbs at 6 knots	Capable of towing packages to 10,000 lbs at 6 knots	Capable of towing at 5 knots with 36,000 lbs trawl drag in low SS 6, best heading
	Capable of towing 25,000 lbs at 2.5 knots	Capable of towing 25,000 lbs at 2.5 knots	Capable of towing at 4 knots with 36,000 lbs trawl drag at 1000 fathoms in low SS 6, all headings

Comparison of Principal Characteristics
SMR/PRV/FRV-40

	Capable of towing in moderate ice conditions	Capable of towing in moderate ice conditions	
Laboratories			
	Total lab area, 2000 sq. ft.	Total lab area, 2600 sq. ft.	Total lab area, 2062 sq. ft.
	Main lab, 1000 sq. ft.	Main lab, 1175 sq. ft.	Fish Laboratory, 388 sq. ft.
	Analytical Lab, 200 sq. ft.	Analytical lab, 600 sq. ft.	Wet Laboratory, 339 sq. ft.
	Wet lab, 500 sq. ft.	Wet lab, 325 sq. ft.	Dry Laboratory, 291 sq. ft.
	Elec/computer lab, 300 sq. ft.	Elec/computer lab, 500 sq. ft.	Autosalinometer Room, 86 sq. ft.
			Chemistry Laboratory, 226 sq. ft.
			Hydrographic Laboratory, 167 sq. ft.
			Acoustic Laboratory, 140 sq. ft.
			Computer Laboratory, 328 sq. ft.
			Controlled Environment Rm, 97 sq. ft.
	Science freezers, 2 @ 100 cu. Ft.	Science freezers, 2 @ 80 cu. Ft.	Science freezer, 1 @ 389 cu. Ft.
	Science office	Science office	
	Climate control chambers, 2 (or vans)	Climate control chambers, 2	
	Electronics workshop	Electronics workshop	Electronics workshop
Vans			
	Two 8 x 20 (or 8 x 10) on aft deck	Two 8 x 20 (or 8 x 10) on aft deck	One 8 x 20 on aft deck
	One 8 x 20 (or 8 x 10) on foredeck		
Workboats			
	One RIB (SOLAS rescue boat)	Two RIB's	One RIB (SOLAS rescue boat)
	One Norwegian Ice Boat	One workboat	One workboat (semi-rigid inboard diesel waterjet)
Science Storage			
	8,000 cu. Ft.	17,600 cu. Ft.	6,000 cu. Ft.
	Hazmat Locker	Hazmat Locker	Hazmat Locker
Acoustical Systems			
	ICES Cooperative Report #209	Conventional echo sounding in SS 4, acoustical DP in SS 5	ICES Cooperative Report #209
	12 kHz echo sounding system	12 kHz echo sounding system	
	3.5 kHz echo sounding system	3 kHz echo sounding system	
	Shallow water multibeam echo sounding system	Multibeam echo sounding system	Multibeam imaging sonar - Kongsberg Simrad SM2000, 90kHz
	SIMRAD EK500 with 200 kHz transducers		SIMRAD EK500 w/ 18,38,120 and 200 kHz transducers
	Side Scan Sonar	Forward looking sonar	Passive sonar
	Acoustic Doppler Profiling system (ADCP) with	Acoustic Doppler Profiling system (ADCP) with	Acoustic doppler current profiler w/ 75 kHz transducer
	150 and 300 kHz transducers	150 and 300 kHz transducers	Acoustic net mensuration system
			Net Sonde System
			Fish Finding system
	Transducer wells (2)	Transducer wells (2)	One transducer well + retractable centerboard
		Doppler speed log	
		Hull mounted transducers for dynamic positioning	
Helicopter			
	Land and refuel	Land and refuel	
Navigation			
	DGPS	GPS	DGPS
	GMDSS	DP relative and absolute in:	GMDSS
		35 knot wind, SS 5, 1.5 knot current, depth to 6,000 m	Inertial Reference System
		excursion plus or minus 150 ft.	

MILITARY

CHAPTER 11
SELF-ELEVATING BARGE PIERS

Section I. DeLong Barges

BACKGROUND

a. The Army has two sizes of self-elevating barges. They are manufactured by the DeLong Corporation and are known as the "A" and "B" units of the DeLong system.

(1) The "A" barge is 300 feet long, 80 feet wide, and 13 feet deep. It is supported by ten 6-foot diameter caissons and ten 500-ton capacity jacks.

(2) The "B" barge is 150 feet long, 60 feet wide, and 10 feet deep. It is supported by six 6-foot diameter caissons and six 500-ton capacity jacks.

(3) In addition, two identical sizes from the Marathon-LeTourneau (M-L) Corporation have been recommended for adoption by the military.

b. Installation and erection procedures for "A" and "B" DeLong barges are outlined in the DeLong jacking systems manual, "Self-Elevating Barge." Therefore, this field manual omits them. It includes all other pertinent information, including fabrication method, design deck loading, supporting systems, operational requirements, past uses and basic considerations in site selection and shore connections.

TYPES

a. Barge. The "A" and "B" DeLong barges are honeycomb-like, welded-steel, box-girder structures consisting of plates and stiffeners. They support a uniform live deck-load of 500 to

600 pounds per square foot. The barges are divided into watertight compartments to maintain safe subdivision in case of towing accidents. Additional watertight compartments provide storage for fresh water and fuel. Each compartment can be entered from the deck through a manhole. The barge has a nonskid deck of 4 by 12 inch wood planking.

b. Caissons. Each caisson is essentially a welded steel pipe 6 feet in diameter and 140 feet long weighing 80 tons. The wall is normally 1 1/2 inches of American Society for Testing and Materials (ASTM) A-131 steel. To ensure lateral stability, a steel diaphragm is positioned 19 feet from the bottom end of each caisson to develop end bearing strength after sufficient penetration. Another diaphragm is fitted 40 inches from the top end. This allows the caisson to float. The load-carrying capacity of the pier and the depth of penetration of the caissons depend on both

the foundation soils and the unbraced length of the caissons. Foundation soils of consolidated clays and nonplastic materials are best. Impenetrable, organic, or highly plastic soils are unsuitable.

c. Air jacks and controls.

(1) Air jacks. An air jack is a barrel-shaped steel cylinder approximately 10 1/2 feet high and 10 feet in diameter. It can raise 500 tons at a nominal rate of 12 feet per hour with a stroke of 12 inches. One jack is provided for each caisson well in the barge unit. The top of the jack is guided by four tie-rods anchored to the deck of the barge. The tie-rods are equally spaced around the air jack. Air jacks are secured to the deck using tie-rods during transit to minimize work at the preparation site.

(2) Controls. A master control panel (Figure 11-l) allows controls to operate simultaneously on all caissons. They can be operated individually by smaller control panels (Figure 11-1) connected by flexible hoses to the three-way valves on each jack. The control valves on each panel regulate the functions of the four major jack components as follows:

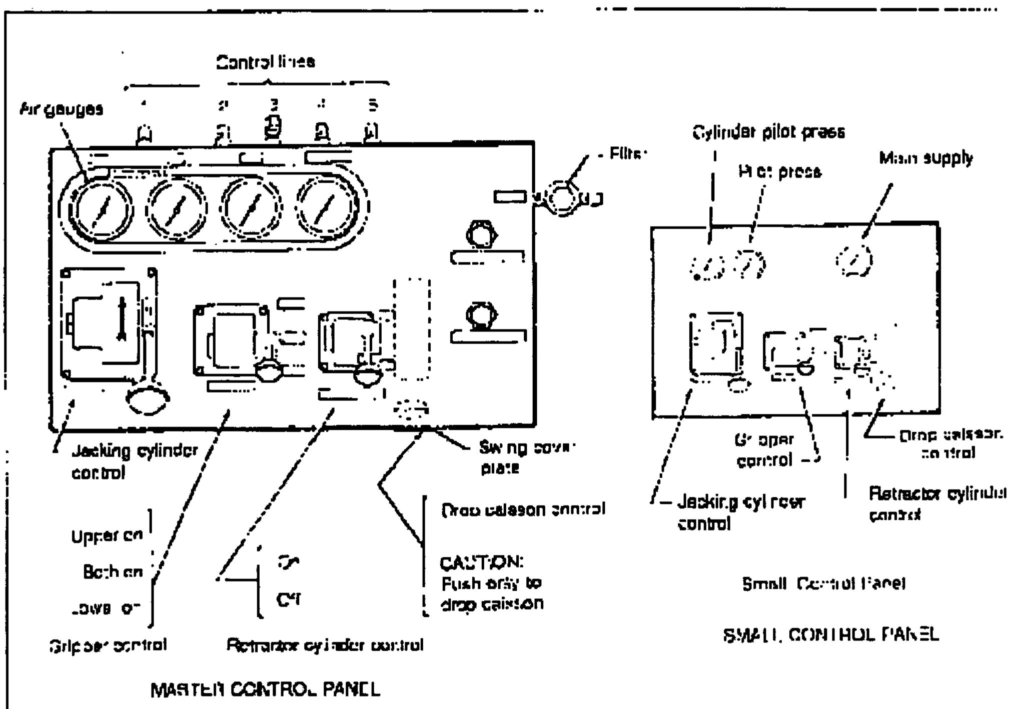

Figure 11-1. Control Panels

(a) The jacking control cylinders govern the jacking cylinders around the jack. When the control valve is "on," compressed air is admitted into the cylinder, causing the jack to lift.

(b) The retractor cylinder control regulates two retractor cylinders, spaced 180 degrees apart on the jack. When "on", this valve allows compressed air to enter the retractor cylinders, causing the jack to close.

(c) The upper and lower grippers are in the upper and lower portions of the jack. Each set of grippers has six rubber tubes inside the jack. Two controls regulate their function: the gripper control and the drop caisson control. The gripper control has three positions. In the "lower on" position, the lower grippers inflate and secure the lower portion of the jack to the caisson. The "both on" position secures the entire jack to the caisson. The "upper on" position secures the jack's upper half to the caisson. The "drop caisson" control overrides the gripper control and deflates both upper and lower grippers, allowing the caisson to drop through

the jack.

d. Miscellaneous equipment.

(1) Shore connection span. Shore connection spans (Figure 11-2) are transported to the erection site by the barge units required for the pier or wharf. Each span is 79 feet long by 30 feet wide by 4 1/2 feet high. The span is of girder construction with four 4 l/4-foot girders supporting a 3/8-inch sheet steel deck. It is shipped split lengthwise into 15-foot sections.

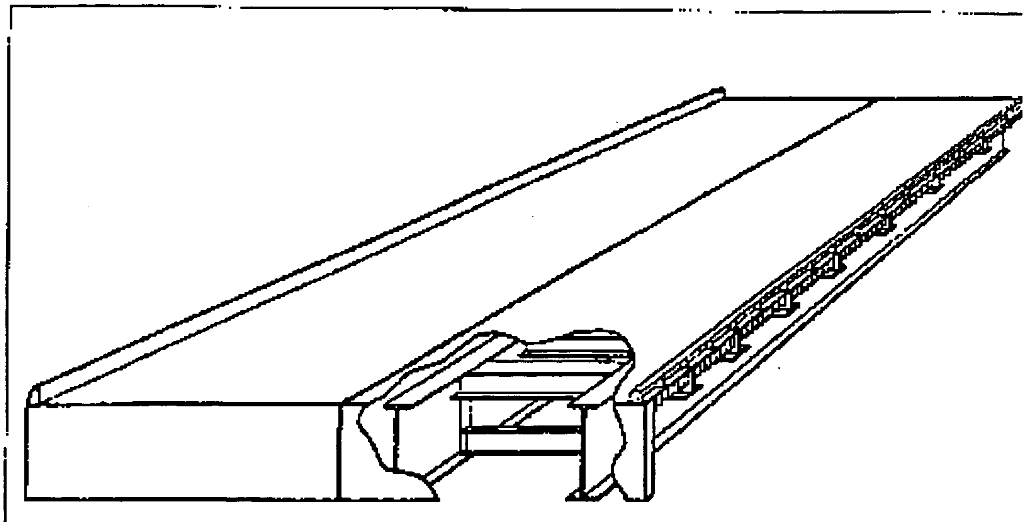

Figure 11-2. Shore Connection Span

(2) Compressors. Two 350-pound per square inch (psi), 400 cubic foot per minute (cfm) air compressors supply sufficient air pressure to operate and control the pneumatic jacks. The compressors should be secured as shown in Figure 11-3. They should be connected by flexible hose to a receiver tank inlet.

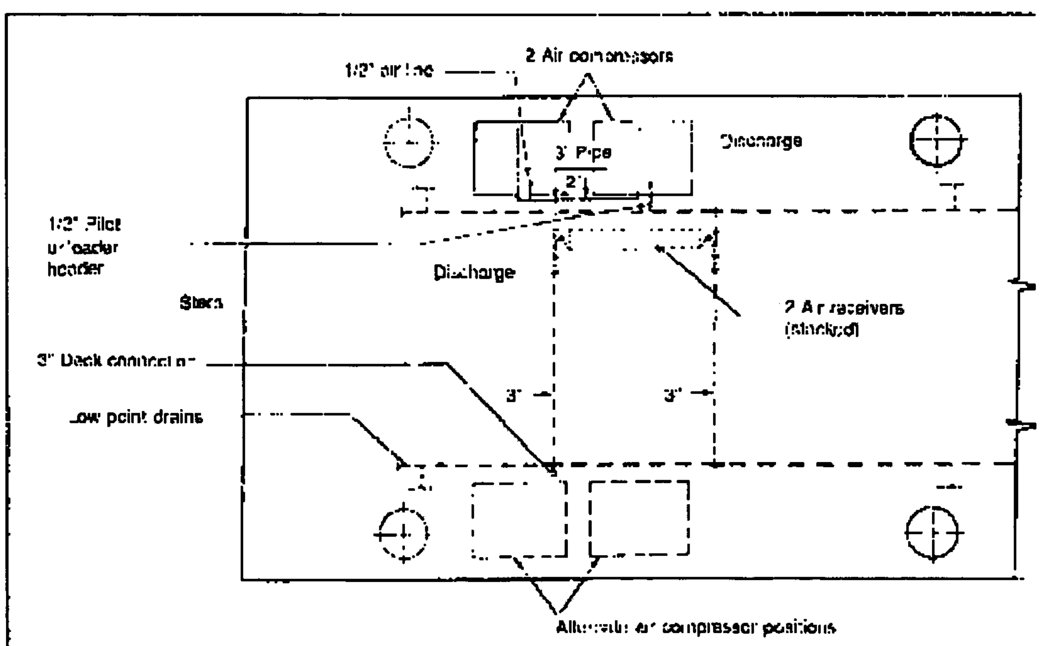

Figure 11-3. Compressor Positions

(3) Weld-off rings. Weld-off rings are pieces of steel tubing with a 10 3/4-inch outside diameter, a 1-inch wall thickness, and a 3-inch length. Eight weld-off rings per caisson are provided for semipermanent installations.

(4) Caisson covers. One steel caisson cover protects the cutoff caisson in a semipermanent installation and provides for each caisson-well in the barge unit.

(5) Fenders. The fenders for the "A" and "B" barges are made of 12 by 12 inch timbers and of 6 foot diameter steel hoops. One is provided per caisson.

e. Accessory equipment. Several items of useful equipment not provided with the barge unit include--

(1) Lifting cranes. The cranes listed below are necessary for erecting self-elevating DeLong barges.

(a) The self-elevating barge may be erected with one large barge-mounted crane. The crane should have a boom at least 200 feet long and a 75 percent tipping load rating exceeding 80 tons. The crane should also be capable of handling a boatswain's chair during lift. In addition, a smaller, at least 40-ton, barge-mounted crane may be used to hasten elevation.

(b) The above crane is not a military adopted item of material. Therefore, it may not be available at the site during construction. In this case, it becomes necessary to use at least two smaller barge-mounted cranes. They should each have a 100-ton capacity and 80-foot booms. Such cranes are available for issue from the Naval Ship Systems Command.

(c) Crawler-mounted cranes are useful in small lifting tasks, such as installing fenders and moving compressors and welding machines.

(2) Welding apparatus. If a large barge-mounted crane is not available, or a semipermanent installation is desired, welding equipment is necessary. Both oxyacetylene and electric-arc welding can be used in barge erection.

(a) Oxyacetylene welding equipment may be used. Only fusion welding with a low-carbon or high-strength steel rod is acceptable. A 300° Fahrenheit (F) to 500° F preheat is required with oxyacetylene apparatus.

(b) Electric-arc welding is preferable. It must be metal arc, using reverse polarity and 25-20 or modified 18-8 stainless steel shielded arc rods. No preheat is necessary.

(3) Pile hammer specifications.

(a) Able to work without shore connection.

(b) Six-foot diameter pile capacity.

(c) Rated striking energy of 120,000 foot-pound.

(d) Capable of sixty blows per minute.

(4) Other floating equipment.

(a) A 600-horsepower, 65-foot harbor tug must tow and position the self-elevating barge, especially if crossing open sea. In calm water, a 200-horsepower, 45-foot tug will suffice.

(b) An LCM is useful in positioning and hauling personnel and material between barge and shore.

(c) Various expedient floats, such as small rafts made from 55-gallon drums and

small outboard motors, help speed elevation. They help particularly after the barge is jacked clear of the water.

SITE SELECTION FOR DELONG BARGE UNITS

a. Tides. Pier or wharf decks are usually positioned about 5 to 6 feet above mean high water. The mean tide range is the difference in height between mean high and mean low water. It is very important in selecting sites for piers or wharves.

b. Soil (foundation) conditions. Table 11-1 contains guidance in planning and site selection. If the erection site is in CONUS data on offshore subsurface soil conditions is available through the US Geological Survey or from the appropriate Corps of Engineers district office. Outside CONUS, data on subsurface soil conditions may be obtained from local sources, the theater army engineer, or military hydrology and hydrographic teams. All data should be checked by the engineer unit commander.

TABLE 11-1. Suitable and Non-suitable Soils for Erecting DeLong Barges

Types	Group Symbols	Suitability
Impenetrable surfaces	-----	Unacceptable
Organic soils	Pt, OH, OL	Unacceptable
Fine-grained clays and silts, wet (mud)	MH, CH	Unacceptable
Fine-grained clays and silts, partly consolidated	ML, MH, CL-CH, CL-CM	Marginal
Fine-grained clays and silts, dry	ML, CL	Acceptable
Sand or sand with silt and clay	SW, SP, SM, SC	Acceptable
Gravel or gravel with silt and clay	GW, GP, GM, GC	Excellent

NOTE: Table based on weight of barge loaded to capacity

c. Wave action. Waves under 3 feet high cause little problem when dropping the caissons. Waves from 3 to 5 feet high require care to ensure that the barge stays in position. Waves over 5 feet high require extreme caution to ensure that the barge remains in place with equipment stowed securely. More time is needed to erect these barges in bad weather.

d. Shore accessibility. Ships must be able to dock under all tide conditions. Shore accessibility comes first in site selection. The depth of water at low tide must be at least 50 feet at the construction site. A distance of up to 1,000 feet between the shore and the end of the wharf or pier is desirable. Local bathymetry may help shorten selection time.

e. Approaches. Site selection should also consider onshore road networks. Construction of a new approach from the road net to the shore connection is expensive. However, the approach and the road net should have the following characteristics:

* Straight for at least 150 feet back from the shore connection to avoid vehicles turning onto the connection.

* Less than 10 percent grade at the shore connection.

* At least two lanes (23-foot) travel width (41-foot clearance width), regardless of the connection width.

* Constructed to withstand deterioration in wet weather.

f. Barge arrangements. There are many practical combinations of barges. Figures 11-4 and 11-5 illustrate some of the most promising arrangements.

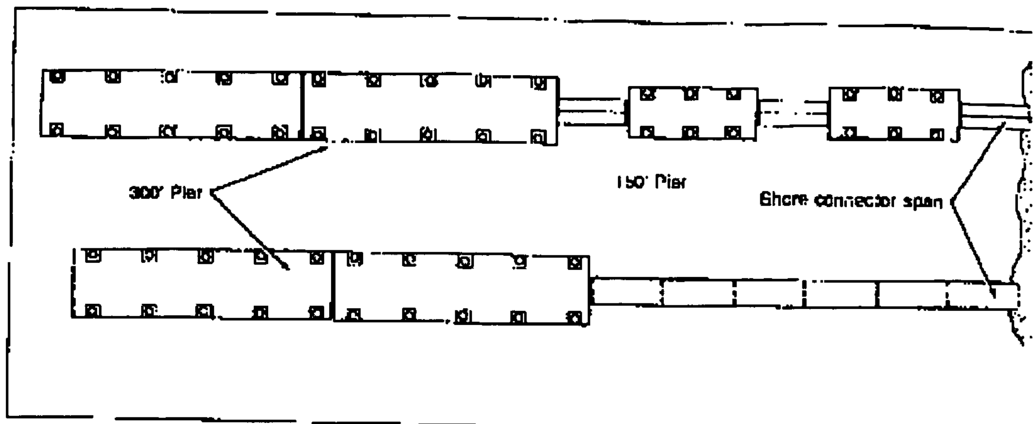

Figure 11-4. Finger Piers

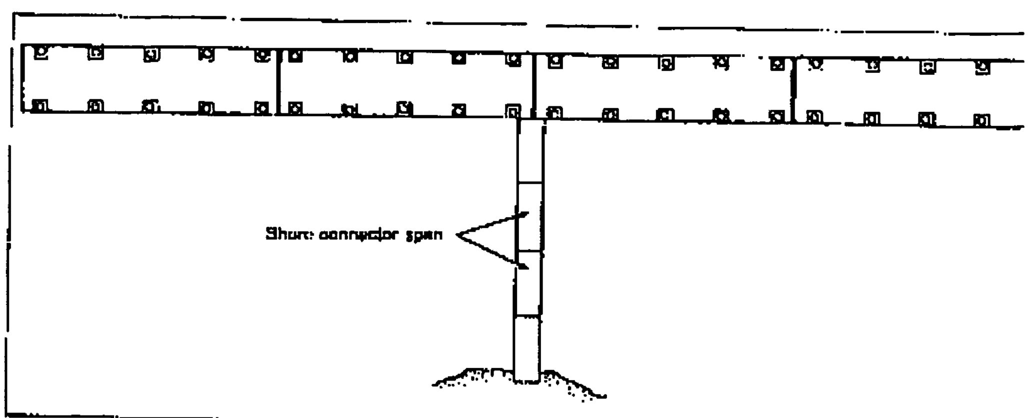

Figure 11-5. T Type Marginal Wharf

PAST USES OF DELONG BARGES IN MILITARY CARGO HANDLING

a. Platforms for floating cranes. A large off-load crane mounted on a floating DeLong barge is one of the best methods for offloading container ships under an open sea of 5- to 6-foot waves and 28-knot winds.

b. Construction of general and/or break-bulk cargo piers. The live-load design of DeLong barges allows them to be used as general and/or break-bulk cargo piers. Barges are jacked to the desired elevation. Grippers within the jacks are inflated to 350 psi. The shutoff locks and isolation valves are closed.

c. Construction of container ports. Modified DeLong barges were used as a military container-handling facility in Camh Ranh Bay, Vietnam. The individual barges of this facility accepted the wheel loads of the container gantry crane. This type gantry crane weighs approximately 1,000,000 pounds and has design wheel loads of about 100,000 pounds on 5-foot centers. The gantry at Camh Ranh Bay had a lifting capacity of 27.5 tons.

LIMITS OF DELONG BARGE PIERS IN CONTAINER-PORT CONSTRUCTION

a. Erection time. Each DeLong barge requires from 24 hours to 8 days for installation, depending on terrain and crew efficiency.

b. Structural integrity. DeLong barge pier design takes a 500-to 600-pound per square foot live load. Modern military container ports need a minimum 1,000-pound per square foot live load. Unmodified DeLong barge piers cannot meet modern container port structural requirements.

c. Container-handling capability. If modified DeLong barges are used to construct a temporary installation, cranes must boom up and down to keep from striking individual caissons. The top of the caissons severely affects the off-loading performance of most container-handling cranes. The barge is also jacked to the desired elevation. Grippers within jacks are inflated to 350 psi. Shut-off locks and isolation valves are closed.

d. Relocation. Temporary installations made with DeLong barges are not easily moved. Semipermanent installations are much more difficult because caissons are driven to refusal, cut off, and then welded to the larger gantries. Seldom is it feasible to relocate them.

e. Foundation limitations. Suitable foundations are limited to consolidated clays and nonplastic materials.

f. Shore-connection spans. Shore-connection spans provided with DeLong barge piers do not possess the structural integrity for handling containers.

g. Fender systems. Historically, fender systems provided with DeLong barges have not operated as desired. Damage has occurred to both vessel and pier. Expedient systems using old tires have been more successful in limiting damages.

Section II. Fenders for Barge Units

PURPOSE OF FENDERING

A fender system protects both the vessel and the docking facility from damage caused by contact between the two during docking. Berthing forces are critical because the loading centers on a small part of the facility. However, situations may occur when a ship is retained at a pier under environmental conditions too dangerous to risk berthing. A ship approaching from an angle of 10 degrees may come in contact with as little as 10 to 30 linear feet of the fender. After mooring, the same ship will normally have about one-half its length resting against the fender.

FENDER DESIGN

a. Fender design for marine structures requires working technical knowledge of the--

(1) Size and berthing velocities of ships.

(2) Magnitudes of surge and wave action.

(3) Hull configurations of ships and other vessels using the facility.

(4) Allowable force and deflection of pier or wharf structure.

(5) Soil conditions.

(6) Velocity and direction of winds.

(7) Tidal variation.

(8) Velocity and direction of currents.

(9) Availability and cost of materials, skilled labor, and equipment.

(10) Skill and experience of pilots.

(11) Approach difficulty.

(12) Availability of tugs.

(13) Amount of list that will occur in vessels, especially floating cranes and derricks.

(14) Willingness of operating personnel to maintain mooring lines.

(15) Presence and activity of marine borers and other causes of gradual deterioration.

(16) Facility design and lift.

b. This large number of factors means that a single standard design for all sites is not appropriate.

FORCES FROM WINDS AND CURRENTS

Table 11-2 shows some of the forces from winds and currents acting on ships. This table shows the importance of mooring a ship parallel to strong currents. Wind and current forces are normally static. But when they combine with surge forces, they can impose large roll and surge movements on a vessel. In this situation, a highly resilient fender system may tend to amplify movement of the vessel. Large movements can quickly damage the pier, ship, and fender. Engineers should change the natural frequency of the ship and its mooring system so that it is out of phase with the combined waves and surge. Some remedial steps are:

TABLE 11-2. Ship Data for Mooring Operations

Vessel	Length ft	Beam ft	Draft ft Light	Draft ft Deep	Loaded Displacement (long tons x 1000)	Area, ft² x 1000 Above Waterline Bow Light	Above Waterline Bow Deep	Above Waterline Beam Light	Above Waterline Beam Deep	Below Waterline Bow Light	Below Waterline Bow Deep	Below Waterline Beam Light	Below Waterline Beam Deep	Force, kips 30-Knot Wind Bow Light	30-Knot Wind Bow Deep	30-Knot Wind Beam Light	30-Knot Wind Beam Deep	4-Knot Current Bow Light	4-Knot Current Bow Deep	4-Knot Current Beam Light	4-Knot Current Beam Deep
Assault Ships																					
LHA	820	106	—	26.0	39.3	5.6	—	...	—	—	2.8	—	21.3	20.2	—	—	—	—	33.8	—	1055
LPD 4	570	84	17.0	22.0	16.9	9.5	3.1	30.0	27.2	1.4	1.9	9.7	12.5	12.7	11.8	108	98.0	12.7	21.7	476	614
LPA 249	564	76	27.0	27.0	18.0	2.9	2.5	22.8	19.3	1.7	2.1	12.4	15.2	10.4	9.0	60	72.0	[illegible]	23.5	610	751
LKA 115	575	82	15.1	25.5	12.3	3.4	2.5	22.2	16.5	1.8	2.1	8.8	14.6	12.2	9.2	80	53.0	11.6	24.1	435	722
LSD 36	555	84	15.0	19.0	13.7	3.5	3.2	28.1	25.0	1.2	1.6	9.2	10.5	12.7	11.0	100	85.0	10.7	19.3	402	520
LST 1179	518	68	11.5	15.0	8.3	2.9	2.1	28.8	25.0	1.8	1.0	6.0	7.6	8.3	7.5	97	90.0	13.8	12.7	294	388
Roll-on/Roll-off																					
Comet	500	78	25.0	29.0	18.3	3.0	2.7	26.6	24.1	[illegible]	2.3	7.0	14.6	10.8	3.7	96	87.3	17.3	25.0	615	717
Sealift	540	83	19.5	29.3	21.5	3.5	2.7	25.0	18.5	1.6	2.4	10.8	15.7	12.4	8.6	96	67.0	14.3	26.9	520	778
Admiral Callaghan	694	92	19.5	27.3	23.7	4.2	3.5	28.8	21.7	1.8	2.5	13.5	18.7	15.2	12.7	108	88.8	15.9	29.8	666	825
General Cargo																					
C-2	455	63	15.0	27.0	13.3	2.0	1.2	19.5	14.0	1.3	1.7	6.6	12.3	7.1	4.4	70	50.0	8.5	19.0	596	608
C-3	492	70	16.0	29.0	18.2	2.5	1.6	21.4	15.0	1.1	2.0	7.6	14.9	9.8	5.5	77	54.0	10.0	22.6	388	705
C-4	564	72	20.0	33.0	22.1	2.6	1.7	23.3	15.0	1.4	2.4	11.4	18.7	9.3	6.9	94	56.0	12.8	26.7	656	828
Tankers																					
T-2	524	68	14.0	30.0	21.6	2.6	1.2	25.8	15.6	1.0	2.0	7.3	15.7	6.9	4.4	86	56.3	8.5	25.0	399	775
T-5	658	86	16.5	35.0	[illegible]	6.7	2.1	31.1	18.0	1.4	3.0	13.9	23.0	13.5	7.8	112	68.0	12.8	34.2	535	1136
MSTS	585	84	14.5	32.5	31.3	5.5	2.0	29.2	17.5	1.2	2.7	7.7	19.4	12.7	7.3	105	63.0	10.9	30.7	578	959
ADR 2	650	95	21.3	35.0	32.0	4.5	2.9	34.1	26.0	1.3	9.2	9.0	27.0	16.6	11.9	122	90.0	11.5	35.2	449	1097
Universe Ireland	1135	175	26.0	79.0	373.9	15.3	6.0	92.2	92.0	4.5	14.0	30.0	89.3	50.0	21.9	342	115.0	40.5	150.0	1450	4428
Barge Transports																					
LASH	860	107	22.0	37.0	81.3	5.7	3.8	49.6	35.0	2.1	4.0	17.2	31.8	23.3	14.0	178	128.0	19.0	48.5	557	1572
Seabee	875	106	17.5	32.0	44.7	5.6	3.7	45.3	33.0	1.9	3.4	15.3	29.0	21.2	16.9	107	118.0	17.0	40.9	755	1386
Break-Bulk Freighter																					
VC-2	455	62	15.5	28.0	15.2	1.9	1.1	16.6	14.0	0.9	1.9	7.1	19.0	6.9	4.0	72	50.0	8.5	19.7	346	946
Mariner	563	76	18.0	30.0	21.2	2.9	2.0	22.6	16.0	1.4	2.3	13.2	17.0	10.4	7.1	82	50.0	12.2	25.6	500	825
Gulf Banker	495	63	18.5	30.0	17.2	2.4	1.0	19.1	13.4	1.3	2.1	9.2	14.9	8.5	5.7	66	40.0	11.4	23.1	450	734
Freighter/Container																					
Seamaster	572	82	21.0	30.5	21.4	3.4	2.6	23.3	18.4	1.7	2.5	12.0	17.5	12.1	9.9	86	67.0	14.5	28.5	506	865
Santa Lucia	560	81	20.0	30.0	21.7	3.9	2.5	23.3	17.5	1.6	2.4	11.2	16.8	11.8	8.0	83	88.0	14.5	27.1	562	830
Wolverine Mariner	564	76	21.5	22.0	22.8	2.0	2.1	25.3	17.0	1.0	2.4	12.1	18.0	10.4	7.6	33	61.0	14.4	27.3	695	659
Challenger	560	75	20.0	31.5	21.1	2.8	2.3	24.0	16.5	1.5	2.4	11.2	17.6	10.1	7.0	87	59.0	13.3	26.8	530	670
Container with Crane																					
Pacific Trader	544	70	21.0	32.0	22.8	2.5	1.7	21.0	15.5	1.5	2.2	11.4	17.4	6.6	6.0	76	35.0	13.1	25.8	580	861
American Liberty	700	90	21.0	32.3	32.6	4.1	2.1	29.0	21.5	1.9	2.3	14.7	22.4	14.6	11.0	105	77.0	16.8	34.8	725	1108
Container without Crane																					
Portland	529	72	22.0	31.0	23.2	2.6	2.0	23.5	15.5	1.0	2.2	11.5	16.2	9.3	7.0	74	56.0	14.0	24.9	565	807
Oakland	665	75	19.0	33.0	32.1	3.0	2.2	24.1	16.9	1.5	2.3	13.1	20.9	11.3	7.8	87	58.0	13.2	27.6	640	1112
Jacksonville	524	66	19.5	31.0	22.0	2.3	1.5	22.0	16.0	1.3	2.1	10.2	16.2	8.3	5.5	70	56.0	11.8	24.3	505	671

a. Hold the ship against the pier with a tugboat or constant-tension winch.

b. Relocate or reorient the facility.

c. Install mooring buoys or dolphins outboard of the pier face.

d. Move bow and stern anchors to the outboard sides of the ship during berthing maneuvers.

e. Change to more or less elastic bow, stern, and breasting lines or install elastic snubbers or dampeners in the mooring lines.

f. Add or remove fender units.

g. Place mooring dolphins inboard of the pier face if there is significant pier movement.

RECOMMENDED TECHNIQUES FOR FENDER DESIGN

Fender system designs must conserve energy. The port construction engineer must determine the amount of energy added to the system. Then he must devise a means to absorb the energy within the force and stress limitations of the ship's hull, fender, and pier. One method for devising a fender system to absorb this energy includes–

a. Determining the energy delivered to the pier upon initial impact (Table 11-3). The selection of a design vessel should be based on recommendations from the Military Traffic Management and Terminal Service and the Military Sealift Command.

TABLE 11-3. Energy to be Absorbed by Fenders

Vessel	Length ft	Beam ft	Draft, ft Light	Draft, ft Deep	DWT (long tons x 1000)	Velocity, ft/sec, Sheltered	Energy, ft-kips, Sheltered	Velocity, ft/sec, Moderate	Energy, ft-kips, Moderate	Velocity, ft/sec, Exposed	Energy, ft-kips, Exposed
Assault Ships											
LHA	820	106	--	28.0	--	0.30	91.7	0.40	163.00	.60	966.70
LPD 4	570	84	17.0	22.0	7.0	0.30	42.8	0.50	111.88	0.70	219.50
LPA 248	564	78	22.0	27.0	6.[illegible]	0.80	48.2	0.50	193.88	0.70	262.40
LKA 113	575	82	15.1	25.5	14.0	0.90	91.3	0.55	104.10	0.80	220.30
LSD 36	555	84	15.3	19.0	5.5	0.30	91.1	0.55	110.12	0.70	169.60
LST 1179	518	68	11.5	15.0	9.5	0.35	25.5	0.60	74.88	0.90	168.56
Roll on/Roll-off											
Comet	500	78	25.0	28.0	6.5	0.30	48.3	0.50	138.73	0.70	271.90
Sealift	540	86	19.5	29.0	12.1	0.30	57.2	0.50	158.80	0.70	311.20
Admiral Callaghan	694	92	16.5	27.0	13.5	0.30	60.5	0.50	188.00	0.70	328.30
General Cargo											
C 2	455	63	15.0	27.0	9.7	0.30	40.4	0.56	135.86	0.80	287.40
C-3	492	70	16.0	28.0	12.7	0.30	52.1	0.50	144.63	0.70	283.60
C-4	564	72	29.0	33.0	14.0	0.30	68.9	0.50	184.16	0.70	361.00
Tankers											
T-2	524	68	14.0	30.0	16.5	0.30	64.5	0.50	179.23	0.70	351.90
T 5	656	86	16.5	35.0	23.6	0.30	99.7	0.45	224.22	0.63	388.60
MSTG	565	64	14.5	32.5	25.5	0.30	86.9	0.46	195.52	0.60	347.60
AOR 2	659	96	21.0	35.0	25.0	0.30	88.6	0.45	194.87	0.60	346.40
Universe Ireland	1135	175	28.0	73.0	326.5	0.20	487.5	0.30	1119.86	0.40	2984.70
Barge Transports											
LASH	860	107	20.0	37.0	44.0	0.30	161.5	0.35	219.63	0.50	449.60
Seabee	875	106	17.5	32.0	27.0	0.30	112.2	0.40	199.48	0.56	374.00
Break-Bulk Freighter											
VC-2	456	62	15.5	28.0	10.6	0.30	45.[illegible]	0.50	127.01	0.80	227.40
Mariner	569	76	18.0	30.0	12.8	0.30	59.4	0.53	164.94	0.70	323.30
Gulf Farmer	495	69	19.5	30.0	11.0	0.30	50.3	0.50	139.6[illegible]	0.70	274.00
Freighter/Container											
Seamaster	572	82	21.0	30.5	12.8	0.30	62.5	0.50	173.80	0.70	340.30
Santa Lucia	560	81	20.0	30.0	12.7	0.30	59.1	0.50	164.23	0.70	321.90
Wolverine Mariner	564	76	21.5	32.0	12.7	0.30	65.7	0.50	182.6[illegible]	0.70	357.90
Challenger	580	75	20.0	31.5	13.5	0.30	60.9	0.50	160.80	0.70	330.80
Container with Crane											
Pacific Trader	544	70	21.0	32.0	12.2	0.30	68.1	0.50	180.58	0.70	373.60
American Liberty	700	90	21.0	32.0	19.0	0.30	87.3	0.46	196.45	0.66	409.07
Container without Crane											
Portland	529	72	22.0	31.0	9.7	0.30	58.6	0.50	182.64	0.70	318.80
Oakland	685	78	18.0	30.0	17.0	0.30	89.3	0.45	230.00	0.65	414.80
Jacksonville	524	61	19.5	31.0	11.6	0.20	68.5	0.50	190.34	0.70	373.10

b. Determining the energy that can be absorbed by the pier or wharf and consider distribution of loading. For structures that are linearly elastic, the energy is one-half of the maximum static-load level times the amount of deflection. Allowance must also be made for other vessels moored at

the pier. A rigid structure can absorb no energy.

c. Subtracting the energy that the pier will absorb from the effective impact energy of the ship to determine the energy the fender must absorb.

d. Selecting a fender design that can absorb the energy determined above without exceeding the maximum allowable force on the pier. Consider that the thickness of the fender will affect the lifting capacity of the ship's gear and dock cranes.

Section III. Shore Connections

Self-elevating, spud-barge, pier units are usually erected as finger piers and, to a lesser degree, as marginal wharves. Since each must be in water deep enough to accommodate modern shipping, they require shore correctors. The following equipment may satisfy these requirements:

a. DeLong Barge Wharf or Pier. One or more of the DeLong "B" units (150 by 60 by 10 feet) may connect the "A units (300 by 80 by 13 feet) to shore. This method jacks the connecting units to the same elevation as the wharf or pier (5 to 6 feet above mean high water). They would be less susceptible to weather than most floating connections.

b. Military bridging. Several military floating bridge units, including amphibious river crossing equipment, are described in Chapter 10. Because of its rapid installation (FM 5-210) and large loading capacities, this equipment can provide shore connections for most types of offshore ports.

c. Navy pontoon gear. Shore connections for many offshore wharves or piers may be provided with the P-series Navy pontoon gear outlined in Chapter 11.

d. Other connections. Pile-supported approaches or earth and rock fill causeways may be used when shore conditions, time, equipment, and material permit.

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Long Term Vessel Charter

General Information

Document Type:	PRESOL
Posted Date:	May 02, 2005
Category:	Transportation, Travel and Relocation Services
Set Aside:	N/A

Contracting Office Address

Department of the Navy, Military Sealift Command, MSC HQ - Washington, 914 Charles Morris Court, SE Washington Navy Yard, Washington, DC, 20398-5540

Description

The Government will require one ice-**strengthened**, self-sustaining, multi-purpose container/breakbulk cargo vessel for a firm charter period of about 10 months and four 12-month options with delivery in December 2005 meeting the folling requirements: ?U.S. flag ?Minimum Speed: 15 knots laden in moderate weather ?Minimum Range: 10,000 nautical miles ?**Deck**: **Strengthened** to **accommodate heavy vehicles**, up to a **M1A1** tank with a uniformly

distributed load of **525** psf. ?Maximum age: 15 years at delivery ?Vessels built in a foreign shipyard must have a minimum of one year of documented service at the time of offer submission ?Cargo Capacity: Vessel shall be able to carry a minimum of 650 TEUs with an average weight of 8 short tons each. Included in this capacity is the ability to carry 100 FEUs ? flat rack and closed containers, and 60 reefers that shall be supplied with 230V/60Hz/3 phase power. In addition to the required container capacity, the vessel shall have 200,000 cf of below-**deck** breakbulk capacity The RFP is scheduled to be released in May 2005. A response time of 20 days between RFP issuance and deadline for proposals is anticipated. This is only a presolicitation notice and is provided for general guidance. The actual requirement will be communicated via the RFP. All the information contained herein is subject to change. Go to http://www.procurement.msc.navy.mil/Contract/RFPSearchEntry.jsp to view the RFP when it is issued.

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